Base Realignment and Closure (BRAC) Cleanup Team Workshop

Innovative Technology

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NSB Kings Bay

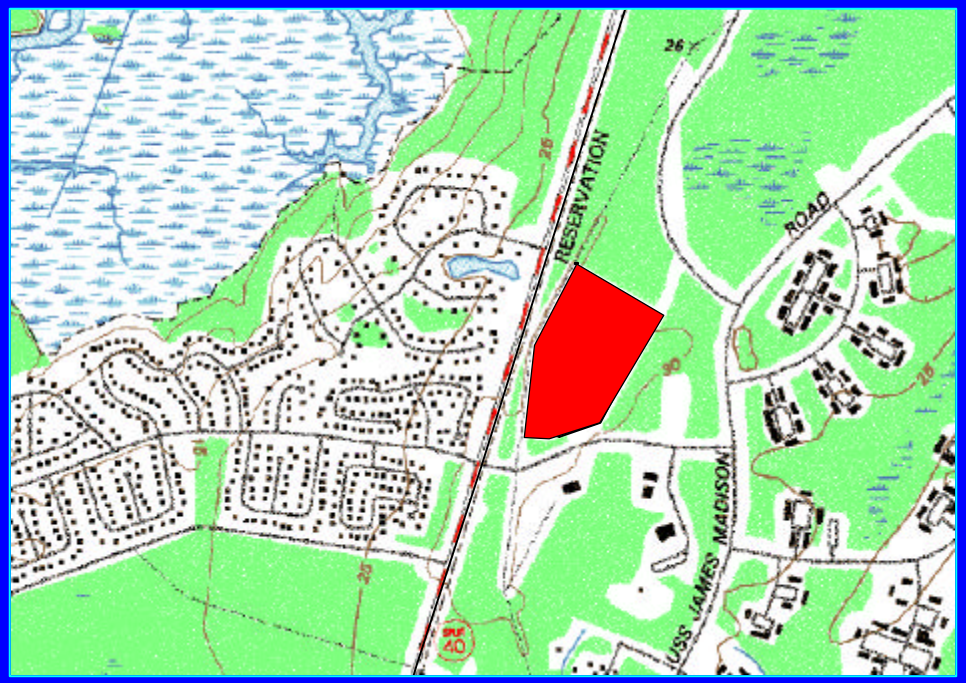
The Use of Natural Attenuation to Select Source Reduction Targets for an In-situ Chemical Oxidation Project


Naval Submarine Base
Kings Bay, Georgia


SC
GA
NSB KINGS BAY
FL

Site 11- Sanitary Landfill

- Domestic Waste
- 1974-1981
- Residential Area west of Landfill



Site 11- Sanitary Landfill

- RFI
  - PCE source area (3 - 4 ppm)
  - PCE/TCE/DCE/VC plume

Adjacent Residential Area

- 630 Homes
- Groundwater
  - not drinking water
  - used for lawn irrigation, washing cars, etc

Chlorinated Solvents Migration

- Landfill source area -- 3-4 ppm PCE
- Roadway ROW -- DCE and VC from 1 - 170 ppb
- Subdivision -- 2-3 ppb DCE

Interim Measure

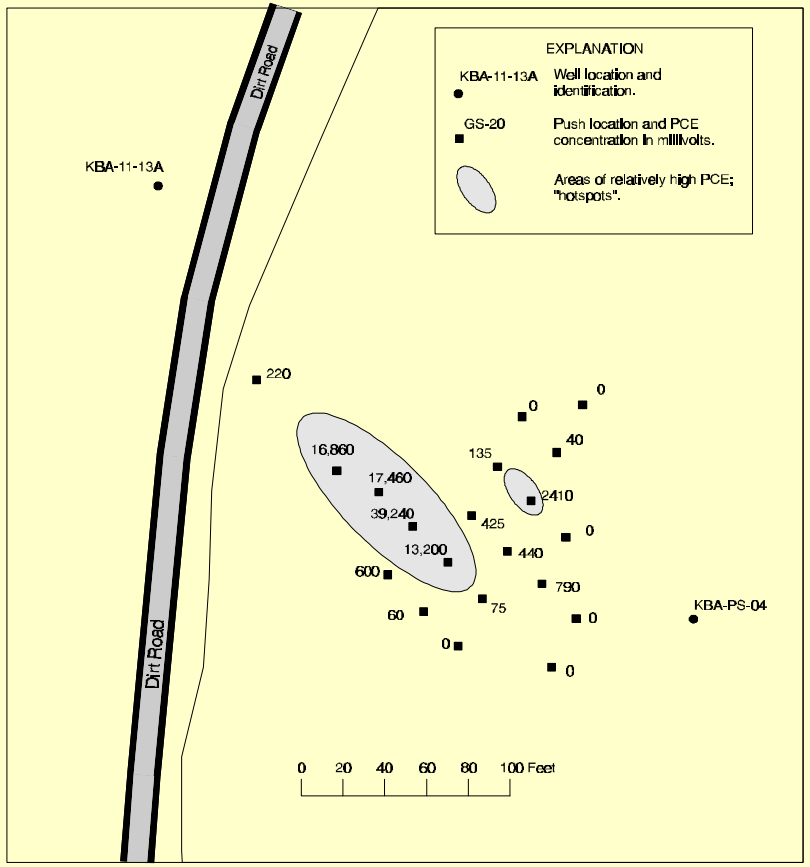
- Pump and Treat for containment
- 3 wells between landfill and subdivision

Additional Measures

- Full capture uncertain
- State requests additional wells, discusses capping
- Navy reviews source reduction techniques and natural attenuation
  - groundwater extraction
  - in-well stripping
  - chemical oxidation

Redox Conditions

- Landfill - Sulfate reducing -- effective reductive dechlorination of PCE, TCE
- Downgradient - Iron reducing -- microbial oxidation of DCE, VC
- Efficient attenuating system
- Lacks distance



Solute Transport Equation

$$dC/dt = D\ d2C/dx2 - v\ dC/dx - SCn - kC$$

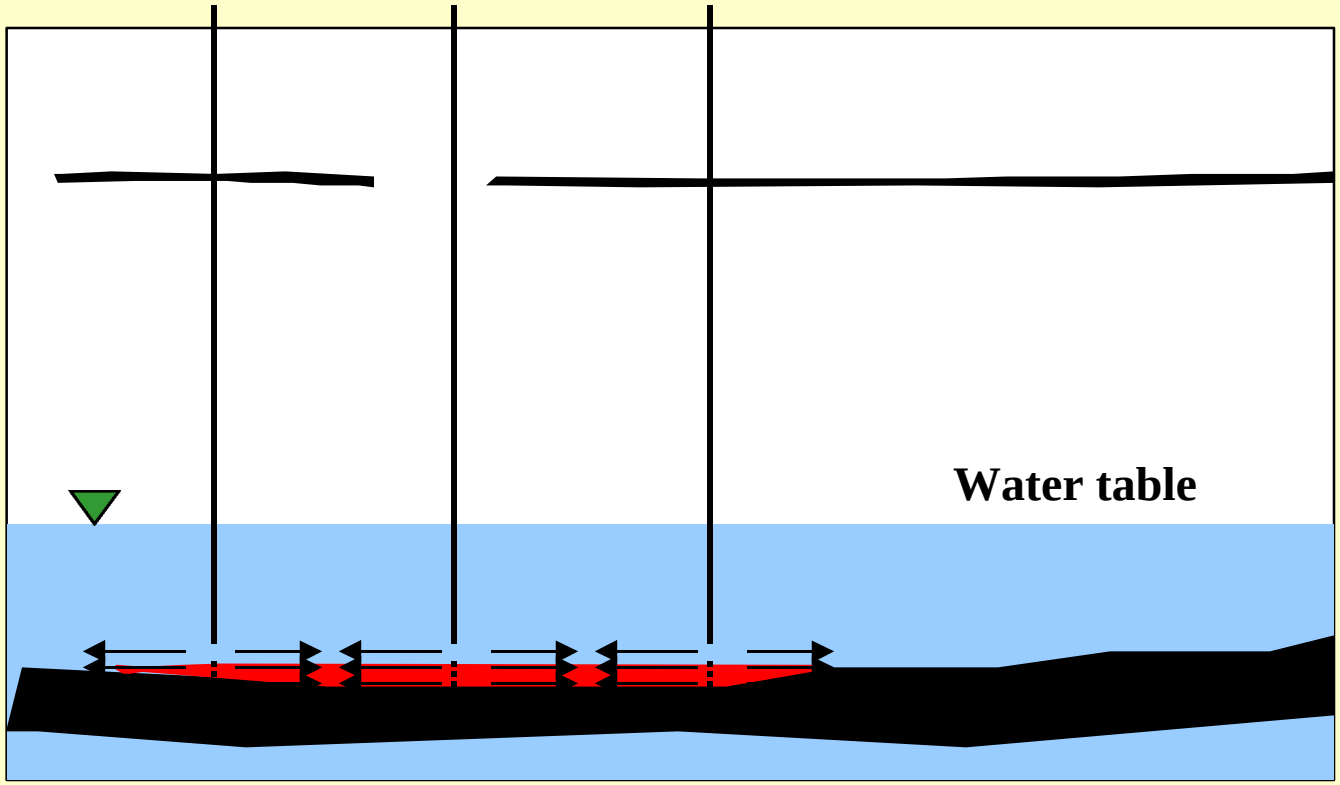
Source Concentration Reduction

- **Design**
- **Uncertainty**
  - Variability of source concentrations
  - Uncertainty and variation of groundwater flow rates
  - Uncertainty of concentrations due to sampling
  - Deviations from steady-state
- Safety factor

Fentons Chemistry

$$H_2O_2 + Fe^{2+} \Rightarrow Fe^{3+} + OH^- + OH\cdot$$

Injection wells are carefully targeted into thin DNAPL accumulation zone



Using a robust pattern of overlapping injection, peroxide and iron II are added to "burn" the DNAPL source in the ground

Technology Selection

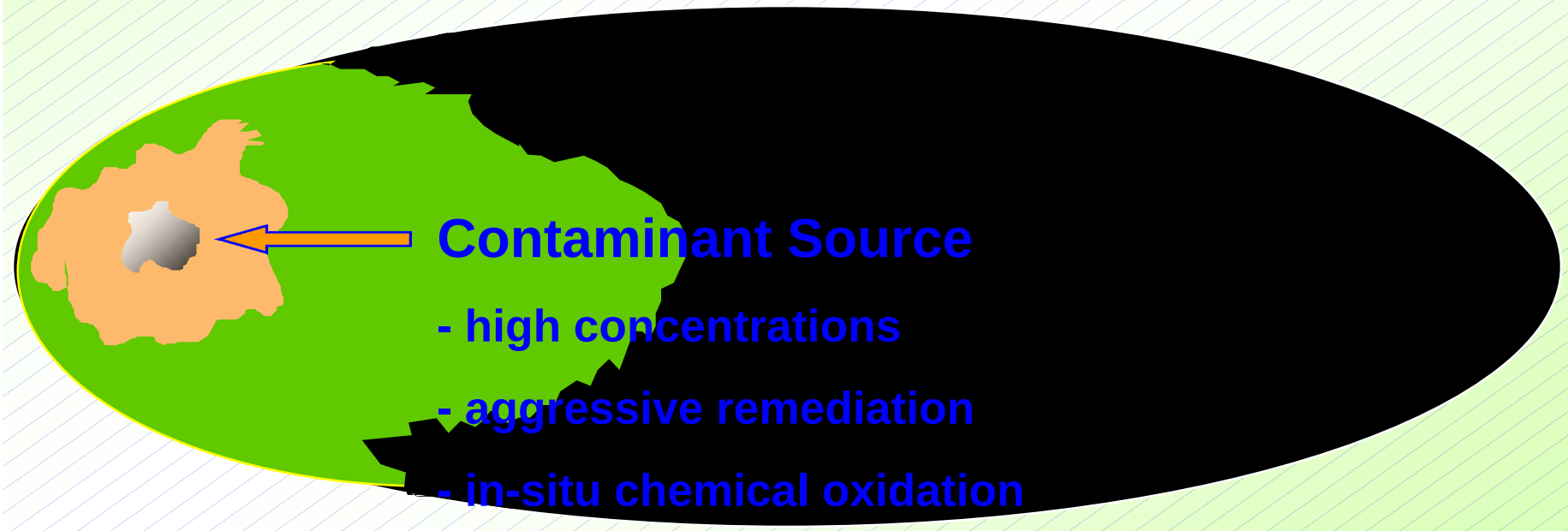
Source Zone

Characteristics: High contaminant concentrations

Need: Aggressive remediation technologies to limit long term environmental damage

Examples: In situ destruction, aggressive immobilization

Specific technology: in situ chemical oxidation (Fenton's Chemistry)



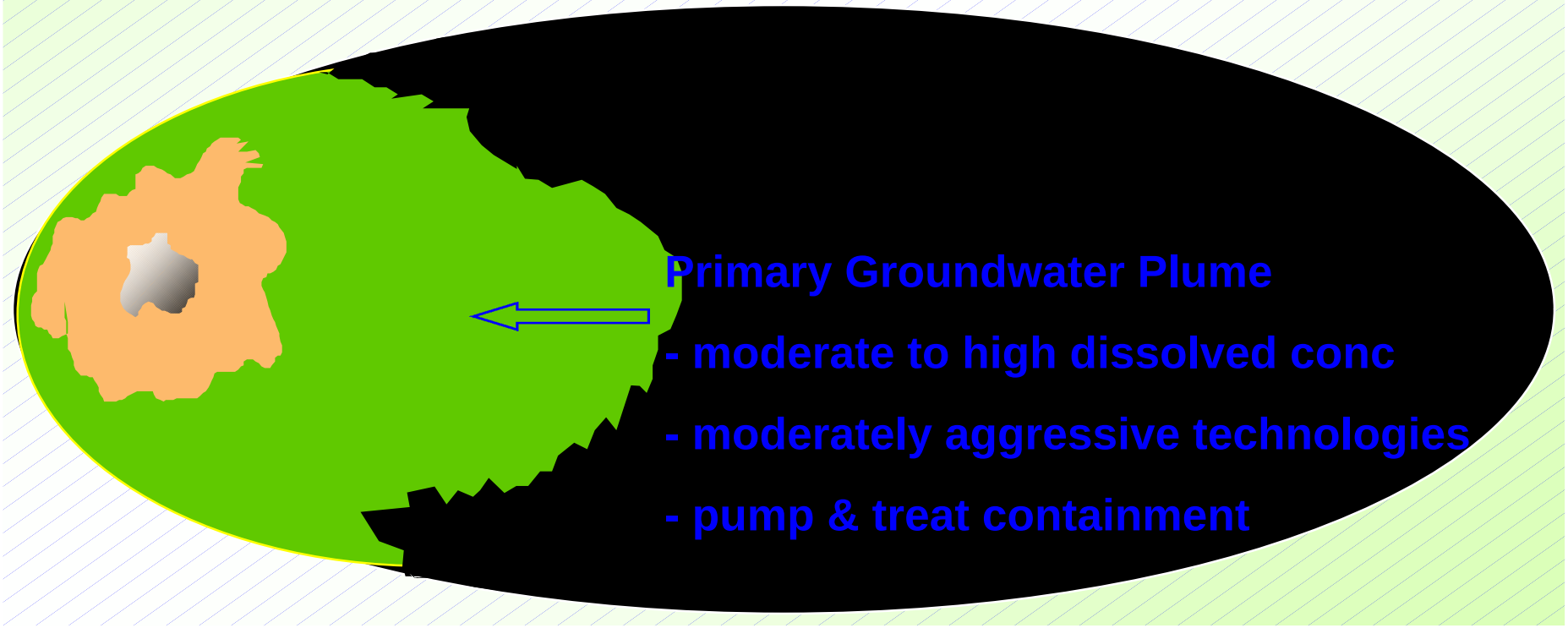
Technology Selection

Primary Groundwater Plume

Characteristics: Moderate to high dissolved concentrations

Need: Baseline technologies or moderately aggressive alternatives

Specific technology: Pump & treat



Technology Selection

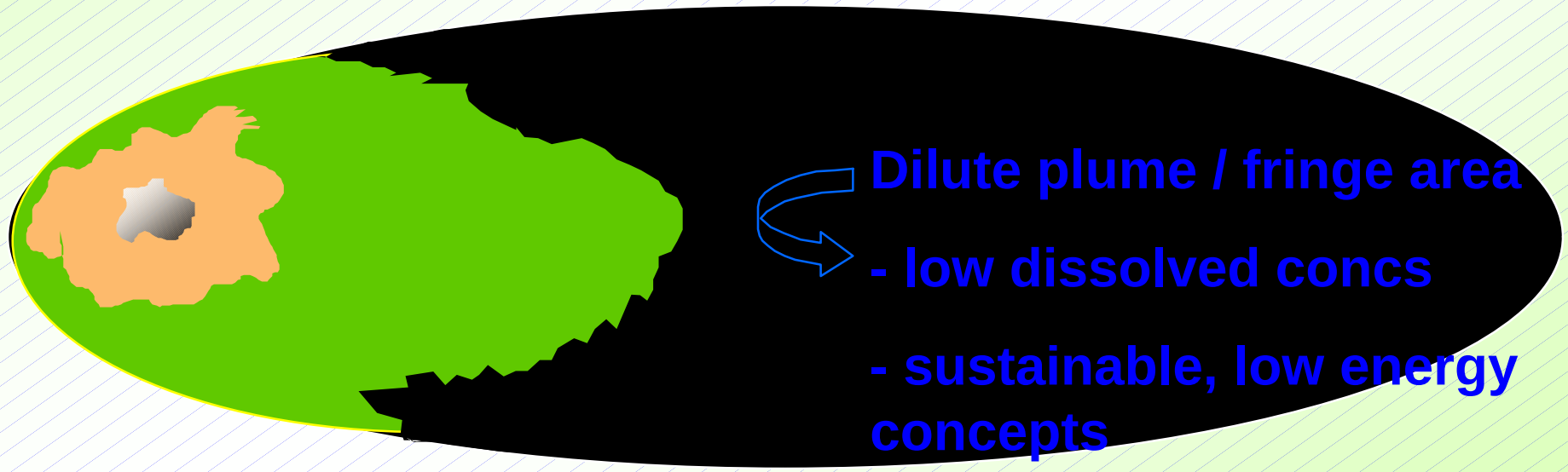
Dilute Plume / Fringe

Characteristics: Low dissolved concentrations

Need: Innovative technologies ... sustainable low energy concepts

Examples: Intrinsic remediation, bioremediation, geochemical stabilization

Specific technology: Monitored natural attenuation



Exit Strategy

- Aggressive source reduction with chemical oxidation (2 to 3 months)
- Continue pump and treat intermediate plume area for about a year
- Turn off pump and treat and monitor for natural attenuation

Benefits

- Reducing source concentration to calculated levels helps ensure natural attenuation processes are effective
- Source reduction and monitored natural attenuation consistent with new EPA guidance
- More efficient and effective than traditional P&T and other methods
- Saves time and money - protective of human health and environment